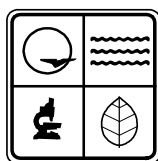


Missouri Aquaculture Environmental and Regulatory Guide

**A Guide to Regulatory Compliance, Sources of
Information and Assistance and Answers to
Environmental Questions for Aquaculture
Businesses in Missouri**



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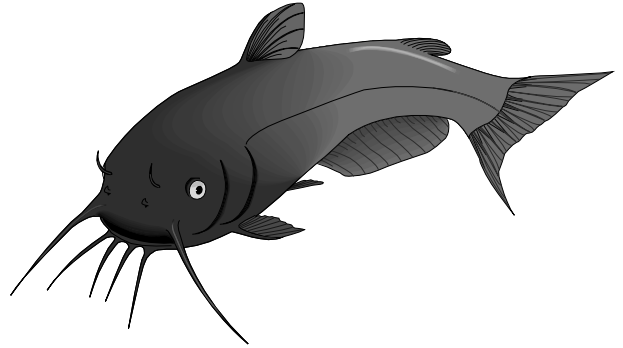
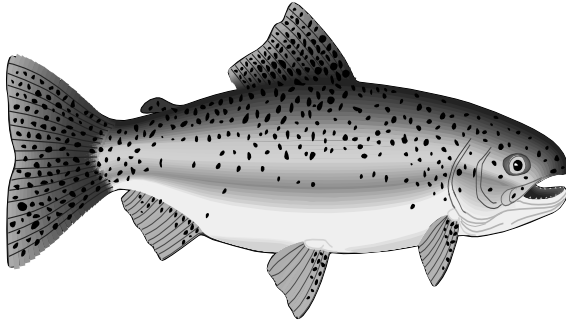
Funding for development and printing of this document was provided in part by a Pollution Prevention Incentives for States grant from the United States Environmental Protection Agency.

The following kindly assisted in developing this document. Their help is very much appreciated.

Missouri Department of Conservation
Missouri Department of Agriculture
University of Missouri
United States Department of Transportation

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
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June 2002



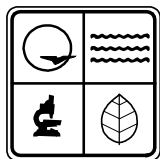
Missouri Aquaculture Environmental and Regulatory Guide

Industries of every type are faced with some big questions.
What regulations apply to me and my facility?
How do I comply with those regulations?
Are there things I can do to reduce the number of regulations I must meet?
How can I protect myself from fines and liability?
How do I protect myself and my employees from environmental hazards at work?

This publication can help aquaculture operations in Missouri answer some of those questions. The guides provide basic information about regulatory requirements and suggestions for protecting yourself, your workers and the environment through pollution prevention.

Each guide sheet deals with a separate issue that you may face at your site. The guides will not answer every question you have. After reviewing them you should be able to decide if you need more information or help on a particular issue. The topics are listed on the back of this page.

The Missouri Department of Natural Resources' Environmental Assistance Office (EAO) can help you comply with environmental regulations and find ways to prevent pollution. If you need help, call EAO at 1-800- 361-4827 and ask for the Agriculture Unit.



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Guide Sheets for Aquaculture

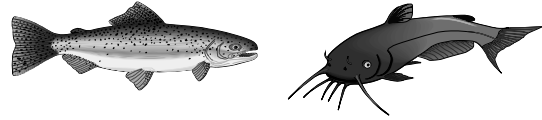
Sheet Subject

1. Pollution Prevention
2. 404 Permits and Wetlands
3. Aquaculture Contacts
4. Species Approved for Aquaculture
5. Backflow Prevention
6. Dead Fish Disposal
7. Discharge Permits
8. Department Permit Applications
9. Drug Use for Aquaculture
10. Drugs, Low Regulatory Priority
11. Endangered Species
12. HACCP Guidelines for Processors of Aquaculture Food Products
13. Hazardous Wastes
14. Lighting Heating and Cooling
15. Missouri Department of Conservation
16. Missouri Department of Conservation Offices
17. Oxygen Tanks on Fish Transport Vehicles
18. Powering Aquaculture Operations
19. Preventing Fish Diseases
20. Private Pesticide Applicator Certification
21. Solid Waste
22. Storm Water Permits
23. Surface Water
24. Wastewater
25. Water Tests for Department Permits
26. Wells and Groundwater

If you have comments or ideas for ways to improve these guide sheets or additional topics that need to be addressed, please let us know by calling EAO at 1-800-361-4827.

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Pollution Prevention



Aquaculture operations deal with many things that can affect the environment. Materials such as cleaners and disinfectants, contaminated storm water and solid waste can harm people and the environment if they are not properly managed. State and federal environmental regulations explain what legally can and cannot be done with these materials. The regulations describe how pollution or waste should be controlled, stored, treated or disposed of. A better solution is to prevent the waste or pollution.

What is Pollution Prevention?

Pollution prevention is simply not making the waste or pollutant in the first place. It means doing what we can to reduce the amount and toxicity of the pollution we generate.

Preventing pollution may be something as simple as using a catch-basin to prevent spills or something as complex as redesigning your operation to increase efficiency and reduce waste. Simple things like choosing nonhazardous cleaners can protect the environment and reduce the number of environmental regulations you face. Pollution prevention means thinking about the environmental impact of your actions and trying to limit that impact.

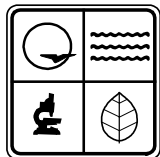
Why Prevent Pollution?

When we generate waste or pollution, we must safely and legally manage that waste or pollution.

Whether it is household trash or waste from a business, managing wastes costs money. And usually the things we discard are items we bought. A good example is paper towels. We buy them, use them once, then pay again to have them disposed.

If we reduce the amount of waste we generate, we can save money. Reducing costs is a major reason to prevent pollution. Here are a few others:

- ✓ Improved work environment and worker safety.
- ✓ Reduced liability.
- ✓ Increased efficiency.
- ✓ Fewer regulatory requirements.
- ✓ Better environmental protection.
- ✓ Enhanced marketing and public relations opportunities.



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What Can be Done at Aquaculture Operations?

There are many ways to prevent pollution at aquaculture operations. Many of these guide sheets have suggestions on ways to prevent pollution. Here are a few general tips:

- ✓ Make a list of your wastes. Try to find a way to eliminate each of them. For example, if you throw away paper towels, consider using washable shop towels.
- ✓ Include the cost of disposal when you make purchasing decisions. What looks like the cheapest option may cost more because of disposal or other management costs.
- ✓ Don't buy more than you need. The leftovers may become waste.
- ✓ Purchase the largest practical container (containers usually end up as waste), but don't purchase more than you need.
- ✓ Purchase the least toxic or hazardous product available. Check the material safety data sheets for products you purchase. If the product is toxic or hazardous, ask your supplier for alternatives.
- ✓ Use the oldest items in your inventory first (first-in, first-out).
- ✓ If you do have excess or unneeded materials, see if your supplier can take them back.
- ✓ Use drip pans and splash guards where spills frequently occur.
- ✓ Fix leaks immediately.
- ✓ Keep work areas clean and well organized to help prevent accidents.
- ✓ Store materials in a way that keeps them from being damaged.
- ✓ Inspect storage areas regularly for leaks.
- ✓ Make sure all items are clearly labeled. Store products in original containers.
- ✓ Store wastes separately and be sure they are properly labeled to make it easier to reuse or recycle them.
- ✓ Store items that could leak in a place where leaks will be contained and easily seen.

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404 Permits and Wetlands



Under Section 404(a) of the Clean Water Act, you must get a permit from the U.S. Army Corps of Engineers (Corps) before placing dredged or fill materials into any "waters of the United States". You might need to do this to build additional ponds or buildings.

The following are not generally considered "waters of the U.S."; however, to reduce legal liability, assume that all rivers, streams, impoundments of watercourses and wetlands are waters of the state.

- ✓ Non-tidal drainage and irrigation ditches.
- ✓ Artificially irrigated areas.
- ✓ Small artificial lakes or ponds.
- ✓ Artificial reflecting or swimming pools.
- ✓ Water-filled depressions, except that water-filled depressions, such as those formed from quarrying, can be waters of the U.S. if the construction or excavation operation is abandoned or completed and the body of water meets the definition of "water of the U.S." or the site has become a wetland.

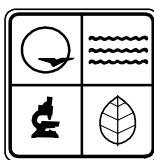
The Corps and the Environmental Protection Agency (EPA) can designate a particular water body as a "water of the U.S." on a case by case basis.

The Corps and the EPA define wetlands as "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

The Corps determines whether an area is a wetland and if an activity requires a permit. The decision is based on vegetation, soil and hydrology. Before issuing a 404 permit, the Corps will coordinate with the Missouri Department of Natural Resources to issue 401 Water Quality Certification for the proposed activity. Certification is required under Section 401 of the Clean Water Act and state law.

Use the map on the back of this sheet to find out which U.S. Army Corps of Engineers District office to contact for assistance.

→ If you plan to excavate or fill in waters of the U.S., including wetlands, you must contact the U.S. Army Corps of Engineers and get any necessary permits before you begin.



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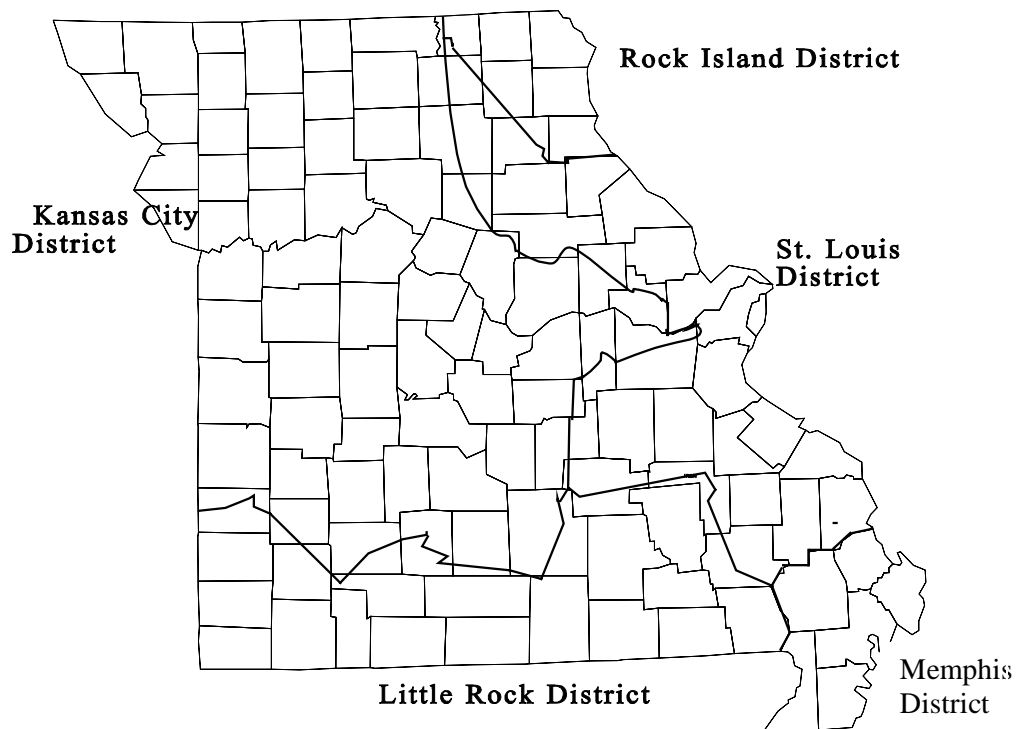


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U.S. Army Corps of Engineers District Boundaries (approximate)



Kansas City District

700 Federal Building, 601 E. 12th St.
Kansas City, MO 64106-2896
(816) 983-3990

Glasgow Regulatory Field Office
(660) 338-2323
Jefferson City Regulatory Field Office
(573) 634-4788
Truman Regulatory Field Office
(660) 438-6697

Rock Island District

Box 2004, Clock Tower Building
Rock Island, IL 61204-2004
(309) 794-5370

St. Louis District

1222 Spruce Street
St. Louis, MO 63103-2833
(314) 331-8575

Little Rock District

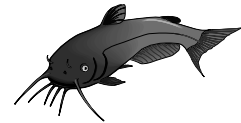
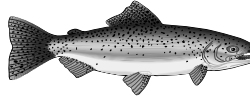
P.O. Box 867
Little Rock, AR 72203
(501) 324-5296

Memphis District

Clifford Davis Federal Building
Room B-202
Memphis, TN 38103-1894
(901) 544-3471

*For more information call 1-800-361-4827 or write to
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Aquaculture Contacts



Missouri Department of Agriculture Aquaculture Specialist

The Missouri Department of Agriculture's aquaculture specialist, provides assistance to the state's growing aquaculture industry. This person works with the Missouri Aquaculture Association providing technical assistance and developing marketing channels. The aquaculture specialist also aids educational institutions, professional/scientific organizations and the general public in promoting Missouri aquaculture.

*Aquaculture Specialist
Missouri Department of Agriculture
1616 Missouri Blvd.
P.O. Box 630
Jefferson City, MO 65102-0630
(573) 526-6666 or 1-800-419-9139
(573) 751-2868 Fax*

University of Missouri Extension Fish and Wildlife Specialist

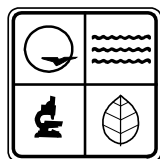
Bob Pierce is the State Fisheries and Wildlife Specialist for University Outreach and Extension. He also provides technical and educational information about aquaculture and serves as the state contact for the North Central Regional Aquaculture Center.

Robert A. Pierce II, Ph.D.
*Fish and Wildlife Specialist
The School of Natural Resources
University of Missouri
302 Anheiser-Busch Natural Res. Bldg.
Columbia, MO 65211-7240
(573) 882-4337
(573) 884-5070 Fax
pierceR@missouri.edu*

In addition, you can contact your county University of Missouri Outreach and Extension Center for aquaculture information.

Other Resources

The Aquaculture Network Information Center (AquaNIC) is maintained at Purdue University.
<http://aquanic.org>



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The North Central Regional Aquaculture Center (NCRAC) can provide fact sheets, technical bulletins, a culture series, a video series and other regional publications and videos. Contact NCRAC at:

*North Central Regional Aquaculture Center
Iowa State University
Office of the Associate Director
124 ScienceII
Ames, IA 50011
(515) 294-5280
<http://ag.ansc.purdue.edu/aquanic/ncrac/>*

*Missouri Aquaculture Association
P.O. Box 6864
Jefferson City, MO 65102-6864
(573) 526-6627
(573) 751-2868 Fax*

*The National Aquaculture Association
P.O. Drawer 1569
Shepherdstown, WV 25443
1-800-626-3301
(304) 876-2251
(304) 876-0946 Fax*

Information Web Sites

Alternative Farming Systems Information Center
www.nal.usda.gov/afsic.htm

Blackwell Science Homepage
www.blacksci.co.uk/

Northern Aquaculture
www.naqua.com/

Aquaculture Magazine Homepage
www.aquaculturemag.com

Aquaculture: An International Journal
www.elsevier.nl/inca/publications/store/5/0/3/3/0/2/

The Aquaculture News Web site
www.theaquaculturenews.com/

American Fisheries Society
www.fisheries.org/

Computer Software

Biosystems Analysis Group
<http://biosys.bre.orst.edu/>

Magazines and Newsletters

Aquaculture in Missouri (AIM)
Newsletter (contact Missouri Department of Agriculture, Aquaculture Specialist to get on mailing list)

Aquaculture Magazine
Northern Aquaculture
ALCOM (Aquaculture for Local Community Development)

Alternative Aquaculture Network Newsletter

Aquaculture Newsletter International

Aquaculture Information Brief

The Aquaculture News

AquaForum Bulletin

Fish Farming News

The North Central Regional Aquaculture Center
Newsletter

Salmonid

Catfish News

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Species Approved For Aquaculture



Fishery resource managers are very concerned about accidental introductions of unwanted species into natural aquatic systems. An infestation of zebra mussels in the Great Lakes and Mississippi River and bighead carp in the Missouri River has focused attention on the environmental and economic problems such exotic nuisance species can cause. There are numerous documented examples from around the world where massive damage to ecological systems has followed the introduction of exotics.

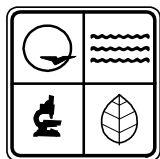
It is virtually impossible to remove or control a nuisance species from the aquatic environment or to prevent its spread. The use of exotic species in aquaculture is of particular concern because of the potential for escape into Missouri lakes and streams.

Rules concerning use of approved aquatic species in Missouri are found in the *Wildlife Code of Missouri* available from the Missouri Department of Conservation (guide sheet #16). This includes the purchase, sale, transport, possession and culture of these animals by private aquaculturists.

Except for species classified as endangered, a permit is not required to culture any fish, crayfish or salamanders, however, the aquaculturist must maintain written proof that cultured species originated from a commercial or private source. Cultured species not on the **Approved Aquatic Species List** must be kept in aquaria or other closed containers where any discharge water goes into an approved municipal waste treatment facility or an on site sand filtration or chlorination system.

A **Wildlife Breeders Permit** is required to culture native frog or turtle species (fee \$50). Specific confinement standards and recordkeeping rules apply to these species.

Species allowable for aquaculture are limited only to those on the **Approved Aquatic Species List** and includes all that are commonly used in Missouri aquaculture. Cultured aquatic species may not be released into any river, stream or other public water without permission from the Missouri Department of Conservation. Reasonable precautions should be taken to prevent landowner permission, any cultured species on the **Approved Aquatic Species List** may be released into privately owned impoundments.



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Importation Permits

Due to the seriousness of certain diseases of trout and salmon, an importation permit is required prior to shipping live Salmonidae, including their eggs and gametes into Missouri. An importation permit will be issued only if the immediate source of the

fish, eggs or gametes is certified negative for Viral Hemorrhagic Septicemia (VHS), Infectious Pancreatic Necrosis (IPN), Infectious Hematopoietic Necrosis (IHN) and *Myxobolus cerebralis* (Whirling Disease) or other diseases that may threaten fish stocks within the state.

Approved Aquatic Species List

The following species, including their subspecies, varieties and hybrids, may be propagated in accordance with provisions of the *Wildlife Code of Missouri*.

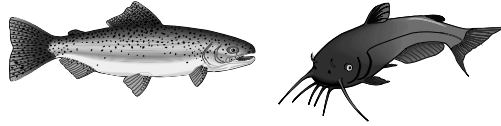
Shovelnose sturgeon	Golden shiner	Longear sunfish
Paddlefish	Bluntnose minnow	Redear sunfish
Spotted gar	Fathead minnow	Smallmouth bass
Longnose gar	Blue sucker	Spotted bass
Shortnose gar	Bigmouth buffalo	Largemouth bass
Bowfin	Black bullhead	White crappie
Gizzard shad	Yellow bullhead	Black crappie
Threadfin shad	Brown bullhead	Yellow perch
Rainbow trout	Blue catfish	Sauger
Golden trout	Channel catfish	Walleye
Cutthroat trout	Flathead catfish	Freshwater drum
Brown trout	Mosquitofish	Bighead Carp
Brook trout	White bass	Northern crayfish
Coho salmon	Striped bass	White river crayfish
Northern pike	Green sunfish	Red swamp crayfish
Muskellunge	Pumpkinseed	Tiger salamander larvae
Goldfish	Warmouth	
Grass carp	Orangespotted sunfish	
Common carp	Bluegill	

Note: The regulations referenced in this guide can be found in the *Code of State Regulations* Title 3, Division 10 (3CSR10) for information on the regulations contact the Missouri Department of Conservation (DOC) See Guide Sheet #16.

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Backflow Prevention



Whether your business uses water from the public water supply or you have a private water supply such as your own well, it is important that you avoid contaminating that water. In some situations, water (and any contaminants it comes in contact with) can flow backwards in a water line. This can contaminate the water in your building and even the entire water supply. Backflow prevention devices prevent this problem.

If you have places where the water line comes into direct contact with a potential contaminant, such as water in a fish tank or pond, the contaminant can travel back into the water line when there is a loss of pressure. This is called a cross-connection. For example, if process water from your rearing tanks flowed back into your water system, your entire water system could be contaminated with fish wastes and uneaten feed.

Backflow prevention devices or assemblies are installed in water lines to keep this from happening. They are placed in water lines entering the building and at points in the water system where it connects to a potential source of contamination.

Missouri Department of Natural Resources' Environmental Assistance Office (EAO) personnel can evaluate your facility for possible

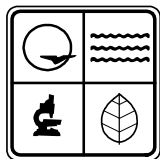
cross connections as part of a non-regulatory site visit, at your request. If your business is connected to a public water supply, state regulations require that you protect the public water supply from cross-connections within your premises. If your operation could cause contamination to the water supply, you must have backflow prevention.

Drinking water regulations require that the backflow prevention assembly be placed on the water service line. It is a good idea to put additional backflow preventers at any location in your business where contamination could occur.

Your local water supplier may have additional requirements regarding backflow prevention. Contact that office to find out.

Even if your business is not connected to a public water supply, you should install backflow prevention devices to protect you, your employees and your customers from the risk of contaminated drinking water and to prevent pollution.

The Department of Natural Resources maintains a list of approved backflow prevention assemblies. To get a copy, call EAO at 1-800-361-4827.



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Remember

- Preventing backflow into the water system protects you, your fish and anyone using your water supply.
- If you are connected to a public water supply system, you may be required to have backflow prevention assemblies or devices.

Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Never fill containers with water by placing a hose end below the water surface because this makes a cross connection.
- ✓ Have plumbing installed by a professional and add backflow prevention at every appropriate point.

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Jefferson City, MO 65102-0176*

Dead Fish Disposal



Dead fish and processing wastes are solid waste.

Mortalities during the production cycle and losses due to disease, as well as fish cleaning and processing wastes, must be disposed of in a way that protects human health and the environment. Good sanitation is also important to protect the health of the remaining fish.

The Missouri Department of Agriculture regulates the disposal of dead agricultural animals. The available options are rendering, composting, burial and disposal as solid waste in a landfill.

The numbers of fish that die in the course of production are usually not large enough to justify rendering or other direct reuse options. Further, rendering is only available in limited areas of Missouri.

Composting of mortalities and non-commercial quantities of fish cleaning wastes is a good alternative. Layers of sawdust and fish waste with a top layer of sawdust to control odors produce a good landscaping material after a short period of time. The compost can be used in flower beds and gardens.

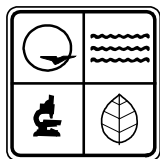
To avoid attracting wild animals and other pests, put your composter inside a fenced area. Use a concrete floored shed with a roof to prevent

liquids from leaking out of the compost. Plans for covered composters used by some of the Missouri State Parks are available by contacting the Missouri Department of Natural Resources' Environmental Assistance Office (EAO).

Composting larger amounts of fish waste such as might be produced by a processing operation may be regulated by the department's Solid Waste Management Program (SWMP) and Water Pollution Control Program (WPCP). Both programs should be contacted before starting to compost to find out what regulations apply.

Burial of animals within 24 hours of death is an acceptable means of disposal. The animals must not be buried in flood prone areas. The site must be at least 300 feet from neighboring residences, wells, sinkholes, public drinking water supply lakes, springs or sinkholes and at least 50 feet from property lines. Contact the department's Geological Survey and Resource Assessment Division (GSRAD) for an evaluation of the groundwater pollution potential at your specific location. GSRAD can offer suggestions about what amount of fish you can bury per acre.

Call the department's toll free number for phone numbers and addresses for the Department of Agriculture, SWMP, WPCP and GSRAD.



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Since dead animals are considered solid waste, they may be disposed of in landfills. However, landfills are not required to accept any specific materials and may choose to refuse to take dead animals or processing wastes. Land application disposal of food processing wastes is regulated by WPCP.

A permit is required and the wastes must be beneficially used as fertilizer.

Catastrophic losses due to equipment malfunctions or disease outbreaks can overtax your existing methods of solid waste management. Have a plan for disposal in the event of such a disaster.

Remember

- Dead animals are solid waste and disposal is regulated by the Missouri Department of Agriculture and the department's Solid Waste Management Program.
- Make plans for what to do in an emergency. Know what is the largest amount of fish you might lose and how you could dispose of it.

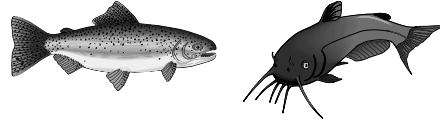
Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Plan to manage your solid wastes in a way that protects the environment.
- ✓ Never bury animals where it might affect water sources or produce a nuisance.

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Jefferson City, MO 65102-0176*

Discharge Permits



To prevent environmental and human health problems, the federal *Clean Water Act* requires a permit to discharge contaminated water called a National Pollutant Discharge Elimination System (NPDES) permit. The requirements of the discharge permit are intended to minimize or prevent water pollution.

The Department of Natural Resources issues these permits, known as Missouri State Operating Permits. Businesses are not required to have permits unless they fit into certain categories and size groups. In Missouri there are two kinds of permits: general permits and site-specific permits.

General Permit

General permits cover an entire industry, but the individual facility operator still must apply for it and pay a small fee. General permits are issued statewide for periods of five years. If a business applies for the permit in the middle of the five-year period, it gets less than five years on the first permit.

Site-Specific Permit

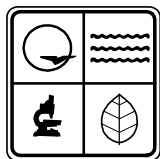
When a business is one of only a few of its kind in the state, it may need a site-specific permit. A site-specific permit takes into account the individual characteristics of the site. In some cases, the department may require the owner or operator of a site to apply for a site-specific permit in order to better protect water quality.

You must apply for and obtain a Missouri State Operating Permit if your aquaculture operation raises cold water fish species and discharges water 30 days or more per year and either;

1. produces more than 20,000 pounds of fish per year or;
2. uses more than 5,000 pounds of feed in the maximum calendar feeding month.

Or if your operation raises warm water fish species and discharges water 30 days or more per year and either

1. the discharge is not from a closed pond during periods of excess runoff; or
2. produces more than 100,000 pounds of fish per year.



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Non-permit Sized Facilities

Facilities that are small or do not normally require a permit because of other exemptions may be required to get an operating permit if they discharge pollutants to waters of the state and the department determines that the discharge poses a significant threat to water quality.

Many lending institutions and insurance companies require that their customers get State Operating Permits to provide greater assurance of environmental protection. No matter how small the facility, it is advisable to apply for a general permit.

Note: If you are required to have a stormwater or wastewater treatment permit for your facility, discharge permit requirements may be combined with the other permits.

Remember

→ If you own or operate a fish farm or hatchery in Missouri, you must have a permit for your discharge if you raise:

- Cold water species and produce more than 20,000 pounds per year or use more than 5,000 pounds per month of feed in the maximum month.
or
- Warm water species and either discharge water other than at periods of maximum flow or produce more than 100,000 pounds of fish per year.

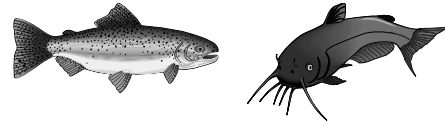
Pollution Prevention

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people. Your permit may require certain pollution prevention practices or even a pollution prevention plan. For example:

- ✓ Get authorization from the department to use fish manure from pond or raceway cleaning as a fertilizer.

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Department Permit Applications



Before you build a new aquaculture operation or modify an existing one, you must check to find out if you need one or more permits from the Missouri Department of Natural Resources. Some of the types of permits you may need are discussed in other guides in this series such as:

- Discharge Permits (Guide Sheet #7)
- Stormwater (Guide Sheet #22)
- Wastewater (Guide Sheet #24)

Construction Permits

If you will construct a wastewater facility, enlarge one or make major changes in your processes, you may need a construction permit. Applications for some types of permits must be prepared by a professional engineer registered in Missouri.

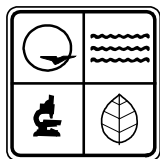
The time period for getting a department permit will vary depending upon the type of permit. Preparing the application, waiting for engineering review from the department, submitting any corrections to the plans and final issuance of the permit may take several months. No construction should be started before the permit is received. After completing construction, the engineer's certification statement, if applicable, must be signed and sent to the department.

Operating Permits

Upon the department's receipt of the engineer's construction certification, operating permit application form and fee, you will be sent an operating permit. Look at your operating permit's expiration date. You will be required to re-apply prior to expiration to maintain your permitted status.

If you want to buy a business that has an operating permit issued by a department division or program, you should check with the department in advance to find out if the permit is transferable and how to transfer it. If you buy a permitted business and transfer the permit, it is imperative that you get a copy of the entire permit application package from the previous owner and become familiar with it.

Many permits have an operation and maintenance section from the engineer's application package that must be followed in operating your business. A list of Best Management Practices (BMPs) is often attached to the permit. If you have BMPs, it is very important that you follow them in order to stay in compliance with the permit's requirements.



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Non-permit Sized Facilities

Facilities that are small or do not normally require a permit because of other exemptions may be required to get an operating permit if they discharge pollutants to waters of the state through accident or mismanagement.

Many lending institutions and insurance companies require that their customers get State Operating Permits to provide greater assurance of environmental protection. No matter how small the facility, it is advisable to apply for a general permit.

Note: If you are required to have a stormwater or wastewater treatment permit for your facility, discharge permit requirements may be combined with the other permits.

Remember

→ If you own or operate a fish farm or hatchery in Missouri, you must have a permit for your discharge if you raise:

- Cold water species and produce more than 20,000 pounds per year or use more than 5,000 pounds per month of feed in the maximum month.
or
- Warm water species and either discharge water other than at periods of maximum flow or produce more than 100,000 pounds of fish per year.

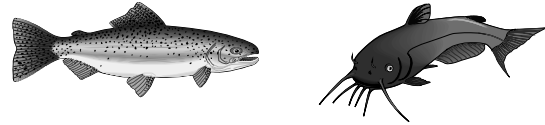
Pollution Prevention

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people. Your permit may require certain pollution prevention practices or even a pollution prevention plan. Here are some suggestions:

- ✓ Following the BMPs in your permit will help you to operate your facility in an environmentally sound manner.
- ✓ When you regrade an area, no matter how small, make sure you use erosion control methods to prevent soil from being washed off the site.
- ✓ Store raw materials, chemical supplies and feedstuff so it is well protected from rain and flooding.
- ✓ After constructing according to your permit, revegetate your site as soon as possible. Use a temporary groundcover if necessary.

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Drug Use For Aquaculture



The U.S. Food and Drug Administration's (FDA) Center for Veterinary Medicine (CVM) regulates the manufacture and distribution of drugs to be used on animals. Fish, crustaceans and shellfish produced by the aquaculture industry are not exempt from FDA regulations.

The FDA outlines three ways that people may use therapeutics to treat animals. The drug and the use must: be generally recognized as effective (GRAE) and safe (GRAS); have an approved new animal drug application (NADA); or be subject of an investigational new animal drug (INAD) exemption.

No aquaculture drugs are either GRAE or GRAS by the FDA at this time. Several drugs currently have approved NADAs for specific species and therapeutic claims in aquaculture. Research under INAD exemptions is underway to gather safety and efficacy data for more drugs. The goal of this research is to gain approval for more drugs and drug uses in aquaculture.

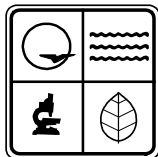
There are two ways that unapproved drugs or approved drugs for unapproved uses may be used.

The FDA lists a few compounds as Low Regulatory Priority Drugs. Low regulatory priority for a specific drug or use of a drug does not mean that the drug or the use is approved under a NADA. Also, the FDA does not claim that the drug is safe and effective for that particular use. (See Drugs, Low Regulatory Priority, Guide Sheet #10)

The other type of low regulatory enforcement priority is the Extra-Label Use Policy for Veterinarians. Extra label means use of a drug for purposes other than those printed on the label or accompanying literature. Only veterinarians may prescribe or use some approved drugs to treat diseases in food-producing animals.

This policy can be used when there may not be an approved drug, or in cases where use of an approved drug may not be effective.

This policy does not permit extra-label use of drugs mixed in feed or extra-label use of drugs by the general public, including fish producers, hatchery managers and fisheries biologists.



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In addition, the extra-label use policy does not permit the use of drugs to prevent disease or for production use (growth promotion, induction of spawning, sex reversal, otolith marking, etc.).

For further information about the INAD or NADA processes, contact CVM's Division of Therapeutic Drugs for Food Animals, at (301) 827-7571 or visit the CVM Web site at <http://www.fda.gov/cvm>.

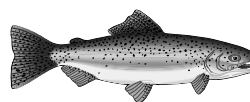
Remember

→ You must report drug use to the DNR Water Pollution Control Program (WPCP) if you have a WPCP Discharge Permit.

*Missouri Department of Agriculture
PO Box 630
Jefferson City, MO 65102-0630
Aquaculture Specialist
(573) 526-6666
1-800-419-9139*

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Drugs, Low Regulatory Priority

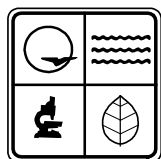


The Food and Drug Administration (FDA) lists only a few compounds as Low Regulatory Priority Drugs. Low regulatory priority for a specific drug or use of a drug does not mean that the drug or

the use is approved under a NADA. Also, the FDA does not claim that the drug is safe and effective for that particular use. (Drug Use for Aquaculture, Guide Sheet #9.)

Low Regulatory Priority Compounds, as of May 1995:

Acetic Acid:	1000 to 2000 ppm dip for one to 10 minutes as a parasiticide for fish.
Calcium Chloride:	Used to increase water calcium concentration to ensure proper egg hardening. Dosages used would be those necessary to raise calcium concentration to 10-20 ppm CaCO_3 . Up to 150 ppm indefinitely to increase the hardness of water for holding and transporting fish in order to enable fish to maintain osmotic balance.
Calcium Oxide:	Used as an external protozoicide for fingerlings to adult fish at a concentration of 2000 mg/L for five seconds.
Carbon Dioxide Gas:	For anesthetic purposes in cold, cool and warm water fish.
Fuller's Earth:	Used to reduce the adhesiveness of fish eggs to improve hatchability.
Garlic (whole form):	Used for control of helminth and sea lice infestations of marine salmonids at all life stages.
Hydrogen Peroxide:	250-500 mg/L to control fungi on all species and life stages of fish, including eggs.
Ice:	Used to reduce metabolic rate of fish during transport.
Magnesium Sulfate:	Used to treat external monogenic trematode infestations and external crustacean infestations in fish at all life stages. Used in all freshwater species. Fish are immersed in 30,000 mg MgSO_4/L and 7000 mg NaCl/L solutions for five to 10 minutes.
Onion (whole form):	Used to treat external crustacean parasites, and to deter sea lice from infesting external surface of salmonids at all life stages.
Papain:	Use of a 0.2 percent solution in removing the gelatinous matrix of fish egg masses in order to improve hatchability and decrease the incidence of disease.



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Potassium Chloride:	Used as an aid in osmoregulation; relieves stress and prevents shock. Dosages used would be those necessary to increase chloride ion concentration to 10-2000 mg/L.
Povidone Iodine:	100 ppm solution for 10 minutes as an egg surface disinfectant during and after water hardening.
Sodium Bicarbonate:	142 to 642 ppm for five minutes as a means of introducing carbon dioxide into the water to anesthetize fish.
Sodium Chloride:	0.5 to 1 percent solution for an indefinite period as an osmoregulatory aid for the relief of stress and prevention of shock in fish; three percent solution for 10 to 30 minutes as a parasiticide.
Sodium Sulfite:	15 percent solution for five to eight minutes on fish eggs to improve their hatchability.
Thiamine Hydrochloride:	Used to prevent or treat thiamine deficiency in salmonids . Eggs are immersed in an aqueous solution of up to 100 ppm for up to four hours during water hardening. Sac fry are immersed in an aqueous solution of up to 1,000 ppm for up to one hour.
Urea and Tannic Acid:	Used to denature the adhesive component of fish eggs at concentrations of 15 g urea and 20 g NaCl/5 liters water for approximately six minutes, followed by a separate solution of 0.75 g tannic acid/5 liters of water for an additional six minutes. These amounts will treat approx. 400,000 eggs.

Reference: Center for Veterinary Medicine Web site, (<http://www.fda.gov/cvm>).

Remember

→ You must report drug use to the department's Water Pollution Control Program (WPCP) if you have a WPCP Discharge Permit.

*Missouri Department of Agriculture
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Jefferson City, MO 65102-0630
Aquaculture Specialist
(573) 526-6666
1-800-419-9139*

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Endangered Species



Endangered species are plants or animals that the prospect for survival of the species is in immediate jeopardy. Federal and state laws protect these species and their habitat. This means that some activities may not be allowed in areas where endangered species live. This may affect you if you are planning to expand operations or site a new aquaculture operation.

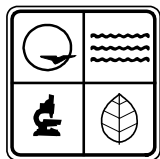
The Missouri Department of Conservation (MDC) is the agency responsible for collecting and managing information on the location and status of endangered species in the state. There are currently 306 species of plants and animals that are listed as State Endangered. The restrictions affecting you depend on whether the species is a plant or animal, whether the land is private property and whether you receive any federal funds. To contact MDC's Natural History Division for general information, call (573) 751-4115.

The MDC booklet, *Endangered Species in Missouri*, gives a very complete discussion of the topic of rare and endangered species. The annually updated *Rare and Endangered Species Checklist of Missouri* is a reference work listing all of the current plants and animals of concern and giving both federal and Missouri status.

There may be times when you need to determine if there are endangered species on a property, such as when you are developing permit applications for a new or expanded site. To get an environmental review of a piece of property, send a request to MDC by mail. If there are no endangered species associated with the property, MDC will issue a letter stating so. Even if you are not required to have an environmental review for endangered species, you may wish to do so, particularly if you are planning to purchase property.

When contacting MDC, it is important to clearly identify the location of the property. The information should include as many of the following as possible: county, topographic quadrangle map designation (if known), legal description (section, township, range) and acreage, permanent landmarks such as rivers and roads, and a copy of a map of suitable scale with the location of the property drawn in and labeled. The request should be sent to:

Policy Coordination
Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102-0180



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Remember

- ➔ It is illegal to harm endangered species or their habitat.
- ➔ Contact the Missouri Department of Conservation for information on endangered species in Missouri.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of it can help to protect habitats. Here are some suggestions:

- ✓ Learn more about rare and endangered species in your area of the state. Find out how you can improve habitat for them.
- ✓ Properly design, construct and maintain detention basins to capture sediment, which is a major pollutant of aquatic environments.
- ✓ Revegetate disturbed areas as soon as possible and in accordance with your permit. Use native plants from a reputable source that provide food and cover for wildlife.
- ✓ Avoid spilling oil, grease and gasoline during vehicle and equipment maintenance activities.
- ✓ Maintain appropriate spill containment equipment and train employees on proper usage.

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
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Jefferson City, MO 65102*

HACCP Guidelines for Processors of Aquaculture Food Products



The U.S. Food and Drug Administration (FDA) has adopted a program of science-based controls focused on preventing hazards that could cause food-borne illnesses. The term HACCP (pronounced "hassip") refers to this program and stands for Hazard Analysis and Critical Control Point. The HACCP procedure involves seven steps in identifying and correcting potential problems in handling food from raw material to finished products. The HACCP program replaces the traditional quality control method of spot-checking and random sampling.

On Dec. 18, 1997, FDA required HACCP regulations for the seafood industry, including producers and processors aquaculture facilities. For more information on HACCP, contact:
Food & Drug Admin
Center for Food Safety & Applied Nutrition 200
5100 Paint Branch Parkway
College Park, MD 20740-3835
1-888-SAFEFOOD, or visit their Web site at
<http://vm.cfsan.fda.gov>

Seven Principles of HACCP:

Analyze hazards:

Identify potential hazards associated with a food.

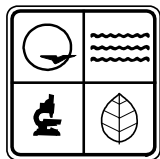
Implement measures to control those hazards.

Potential hazard examples:

Biological (bacteria)

Chemical (disinfectant, pesticide)

Physical (ground glass, metal fragments)



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Identify critical control points:

Control or eliminate potential hazards at points in food production (raw materials through processing and shipping to consumption by the consumer).

Examples:

- Cooking
- Cooling
- Packaging
- Metal detection

Establish preventive measures with critical limits for each control point:

For example, set the minimum cooking temperature and time required to ensure the elimination of any microbes.

Establish procedures to monitor the critical control points:

Determine how and by whom cooking time and temperature should be monitored.

Establish corrective actions to be taken when a critical limit has not been met:

For example, reprocess or dispose of food if the minimum cooking temperature is not met.

Establish procedures to verify that the system is working properly:

For example, test time-and-temperature recording devices to verify that a cooking unit is working properly.

Establish effective record-keeping to document the HACCP system:

Record hazards and their control methods.

Monitor safety requirements.

Take actions to correct potential problems.

Each of these principles must be backed by sound scientific knowledge: For example, published microbiological studies on time and temperature factors for controlling foodborne pathogens.

Reference:

Center for Food Safety and Applied Nutrition Web site, (<http://vm.cfsan.fda.gov>).

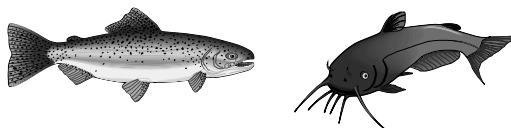
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Jefferson City, MO 65102*

June 2002

Hazardous Wastes



Note: The federal requirements for hazardous waste can be found in the *Code of Federal Regulations*, Title 40, Part 260 through Part 280 (40 CFR 260-280). The Missouri Hazardous Waste Law is in the *Revised Statutes of Missouri* (RSMo), Sections 260.350-260.575. The hazardous waste rules are in the *Code of State Regulations*, Title 10, Division 25 (10 CSR 25). To get information on the regulations, call the Missouri Department of Natural Resources at 1-800-361-4827 or the federal government's Superfund/RCRA hotline at 1-800-424-9346.

Some chemicals used in aquaculture may produce hazardous wastes. It is very important that you find out if your wastes are hazardous and that you follow the law when managing the wastes. The department's Environmental Assistance Office (EAO) provides non-regulatory site assessments that help businesses identify and manage hazardous wastes

What is a Hazardous Waste?

A waste is a material you no longer use and will discard. It can be a solid, liquid or gas. Hazardous wastes are dangerous to human health and the environment if managed improperly. Cleaning solvents, pH adjustment chemicals and medicines are examples of wastes that could be hazardous.

It is your responsibility to find out if your waste is hazardous. A waste is hazardous if

- ✓ It is listed as a hazardous waste in the federal regulations;
- ✓ It exhibits a hazardous characteristic;

- ✓ It is a hazardous waste by Missouri law; or
- ✓ It is a mixture of a listed hazardous waste and any other waste.

Listed Hazardous Waste

The federal government publishes lists of hazardous wastes. There are four different lists: the F list, the K list, the P list and the U list. Wastes on the P list are called "acutely hazardous" and are regulated more strictly than other types.

Characteristic Hazardous Waste

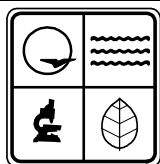
Some wastes that are not on the lists may still be regulated hazardous wastes because they have characteristics that make them hazardous. There are four characteristics:

Ignitable - A waste with a flashpoint less than 140 F, solids that catch fire easily and burn so rapidly they create a hazard, and some compressed gasses. Some solvents are ignitable.

Corrosive - A waste with a pH less than or equal to 2.0 or greater than or equal to 12.5. An example is battery acid.

Reactive - Wastes that are normally unstable, react violently with water, can explode or release poisonous gases.

Toxic - Wastes containing certain organic chemicals, heavy metals or pesticides when tested by the Toxicity Characteristic Leaching Procedure (TCLP). The chemicals considered toxic are included on a list in the federal regulations.



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Missouri-specific Hazardous Waste

An individual state can regulate wastes as hazardous even if they are not on the federal list.

For example, in Missouri certain dioxin wastes are regulated at smaller quantities than in the federal rules.

The “Mixture Rule”

If you mix any material with a waste that meets the definition of a F, P, K or U listed, waste, the mixture is hazardous, even if there is only a very small amount of listed hazardous waste in the mixture.

Is Your Waste Hazardous?

To find out if your waste is hazardous, check to see if it is on the list of hazardous wastes or if it is a hazardous waste in Missouri. If it is not, you need to find out if it exhibits one or more of the hazardous characteristics. Check the material safety data sheet (MSDS) or contact your supplier for information.

If you are unsure if your waste is hazardous, you will need to have it tested in a laboratory. Contact the Department of Natural Resources at 1-800-361-4827 for help with this.

Managing Hazardous Wastes

There are very specific requirements for managing hazardous waste from your business. The requirements you must meet depend on what and how much waste you generate. You need to know how much acutely hazardous waste (P-listed) and non-acute hazardous waste you generate each month. You also need to know how much of each of these types of waste you accumulate at any one time.

What Type of Generator Are You?

There are three types of generators: Large Quantity Generator (LQG), Small Quantity Generator (SQG) and Conditionally Exempt Small Quantity Generator (CESQG). Here are some general guidelines to help you decide what type of generator you are:

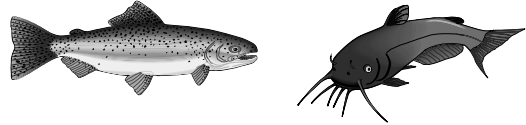
If you generate in one month or accumulate at any one time . . .

- ✓ more than 1 kilogram (2.2 pounds) of acutely hazardous waste you are an LQG.
- ✓ 1,000 kilograms (2,200 pounds) or more of non-acute hazardous waste you are an LQG.
- ✓ more than 100 kilograms (about 220 pounds), but less than 1,000 kilograms (2,200 pounds) of non-acute hazardous waste and less than one kilogram of acutely hazardous waste you are an SQG.
- ✓ no more than 100 kilograms (220 pounds) of non-acute hazardous waste and less than one kilogram of acutely hazardous waste you are a CESQG.
- ✓ In Missouri, anyone generating one gram or more of dioxin waste (2,3,7,8-tetrachlorodibenzo-p-dioxin) is an LQG.

If you are a SQG or LQG you must register with the department and get a generator identification number. You also must follow regulations on storage, transport, recordkeeping and reporting. Call EAO to learn the specific requirements for managing your waste.

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Lighting, Heating and Cooling



Lighting. Electricity required for lighting can be reduced by 50 percent through the use of new lighting technologies. These new technologies also can improve working conditions in processing areas, labs and offices. Although every application must be judged separately, some lighting retrofits are generally useful, especially for aging lighting systems.

For example, most existing fluorescent lighting systems can be cost-effectively upgraded to T-8 lamps and electronic ballasts. Compact fluorescent lights (CFLs) are available in a wide range of sizes and wattages, making them good replacements for incandescent lamps if the light is to be operated one or more hours a day. Mercury vapor lamps can be replaced with metal halide lamps that are much more efficient.

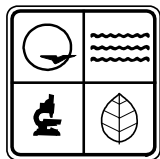
Occupancy sensors that detect the presence (or absence) of people can be used to turn lights on or off, reducing energy cost of lighting unoccupied spaces. Using natural light from the sun to illuminate a building is generally a practical consideration. Department

of Natural Resources' Energy Center has information available on efficient lighting.

Heating, ventilating and air conditioning (HVAC) systems in buildings can be a source of significant energy consumption. HVAC systems provide heating, cooling, humidity control, filtration, fresh air makeup, building pressure control and comfort control.

Properly designed, installed and maintained HVAC systems are efficient, provide comfort to the occupants and inhibit the growth of molds and fungi. Well-designed, efficient HVAC systems are essential for improving an operation's profit margin.

Certain types of aquaculture systems may heat or cool their water. Typically, doing so is very expensive. Should heating or cooling of water be necessary, consider the use of high-efficiency boilers and chillers.



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Ground or water source heat pumps are gaining popularity and can be a sound economic decision for aquaculture operations. Contact the department's Energy Center regarding these applications, and don't forget to inquire about the potential for solar applications at your site.

Energy efficiency and renewable energy can improve the economics of your operation, reduce

electrical demand, conserve fossil fuels and protect Missouri resources. For additional information on any of the above or additional energy related topics, contact

Energy Center

P.O. Box 176

Jefferson City, MO 65102

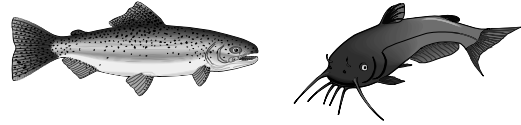
Phone: (573) 751-3443 or 1-800-361-4827

Remember

→ Energy use is a major expense and more efficient equipment may pay for itself in a short time.

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Missouri Department of Conservation



The Missouri Department of Conservation (MDC) is responsible for management and protection of native wildlife species. A few activities related to aquaculture are regulated by MDC. The Department of Conservation's Fisheries Division can provide information and assistance to aquaculturists through any of its 10 regional offices.

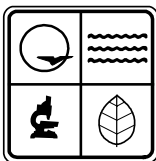
According to the *Missouri Wildlife Code*, 3CSR10-9.110(3), Fish, crayfish and salamanders may be bought, sold, transported, propagated, taken and possessed by any person without permit throughout the year in any number or size and by any method providing:

(A) That person has in his/her possession a dated, written statement showing the number or quantity of each species as proof that such animals were obtained from other than waters of the state or from a licensed commercial fisherman, provided that animals from outside the state were legally obtained from a commercial source.

(B) That person is in compliance with all provisions of the Wildlife Code of Missouri pertaining to importation, purchase or sale of endangered species, and importation of live fish or viable fish eggs of the family Salmonidae.

(C) That the privileges of this section do not apply to taking or possession in, on or from waters of the state, waters stocked by the state, or waters subject to movements of fishes into and from waters of the state, except:

1. Animals defined as live bait and possessed under provisions of this section may be possessed on the waters of the state for use as live bait.
2. Fish cultured by a commercial fish producer that remain in a manmade impoundment following an inundation by flooding from waters of the state as defined in this Code shall be considered the property of the impoundment owner; provided the remaining fish species are the same as were present in the impoundment prior to inundation. Any other fish species in the impoundment shall be returned unharmed immediately to the waters of the state when harvested.



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(D) That the privileges of this section apply only to species listed in the Approved Aquatic Species List (including all subspecies, varieties and hybrids of the same bought, sold, transported, propagated, taken and possessed for purposes of aquaculture), species frozen or processed for sale as food products, species incapable of surviving in fresh water, species held only in aquaria or other closed containers having water discharged only into approved municipal waste treatment facilities or on site waste treatment systems that include sand filtration or chlorination, or with written authorization of the director. (The Approved Aquatic Species List is available in guide sheet #4.)

Fish Importation Permits 3CSR 10-9.110 (4)

Live fish, their eggs and gametes of the family Salmonidae (trout, char and salmon) may be imported to the state only by the holder of a fish importation permit and any other appropriate state permit. This importation permit shall be issued at no charge, for each shipment, to a person who has applied upon a special form furnished by the department, if this application is received not less than 15 nor more than 80 days prior to the shipment, and if the shipment is considered not detrimental to the fisheries resources of the state. This permit will be issued only if the immediate

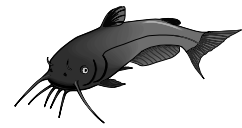
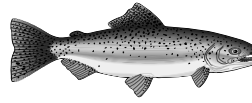
source of the importation is certified negative for Viral Hemorrhagic Septicemia, Infectious Pancreatic Necrosis, Infectious Hematopoietic Necrosis, Myxobolus cerebralis, or other diseases, which may threaten fish stocks within the state. Certification will only be accepted from federal, state or industry personnel approved by the department and only in accordance with the provisions on the permit application form. Fish, eggs and gametes imported under this permit are subject to inspection by authorized agents of the department and this inspection may include removal of reasonable samples of fish or eggs for biological examination.

The Department of Conservation stocks ponds with fish upon request of the owner. The pond owner retains full rights to control access to their land, but all fish are subject to the regulations presented in the *Wildlife Code of Missouri*, 3 CSR 10-4.110 (8). With landowner permission, any species listed in the Approved Aquatic Species List in 3CSR10-9.110 may be released into privately-owned impoundments that are designated as waters of the state by virtue of having been stocked by the state, or because they are owned jointly, or as tenants in common or by corporate shareholders. Statewide seasons, methods and limits for all species will apply to these waters.

Wildlife Code of Missouri definition of waters of the state: All rivers, streams, lakes and other bodies of surface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned or leased by a single person or by two (2) or more persons jointly or as tenants in common or by corporate shareholders, and including waters of the United States lying within the state. Water of the state will include any waters which have been stocked by the state or which are subject to movement of fishes to and from waters of the state. 3CSR 10-11.805(50)

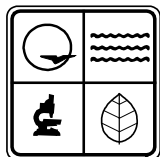
*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Missouri Department of Conservation Offices



The Missouri Department of Conservation is responsible for management and protection of native wildlife species. The Department of

Conservation's Fisheries Division can provide information and assistance to aquaculturists through any of its ten regional offices.



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MDC REGIONAL OFFICES

Administrative Office

P.O. Box 180 (zip 65102)
2901 W. Truman Blvd.
Jefferson City, MO 65109
(573) 751-4115
(573) 751-4467 Fax

Northwest

701 N.E. College Drive
St. Joseph, MO 65407
(660) 271-3100
(660) 271-3107 Fax

Northeast

2500 S. Halliburton
Kirksville, MO 63501
(660) 785-2420
(660) 785-2553 Fax

Kansas City

3424 NW Duncan Road
Blue Springs, MO 64015
(816) 655-6250
(816) 655-6256 Fax

Central

1907 Hillcrest Drive
Columbia, MO 65201
(573) 884-6861
(573) 882-9807 Fax

West Central

2010 S. 2nd Street
P.O. Box 368
Clinton, MO 64735
(660) 885-6981
(660) 885-5038 Fax

St. Louis

2360 Highway D
St. Charles, MO 63122
(636) 441-4554
(636) 926-9125 Fax

East Central

Jct. I-44 and Hwy. 185 S.
P.O. Box 248
Sullivan, MO 63080
(573) 468-3335
(573) 468-5434 Fax

Southeast

2302 County Park Drive
Cape Girardeau, MO 63701
(573) 290-5730
(573) 290-5736 Fax

Ozark

P.O. Box 138
551 Joe Jones Blvd.
West Plains, MO 65775
(417) 256-7161
(417) 256-0429 Fax

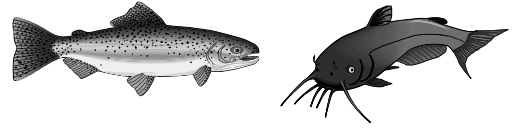
Southwest

2630 N. Mayfair
Springfield, MO 65803
(417) 895-6880
(417) 895-6910 Fax

Web site Address: www.conservation.state.mo.us/

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Oxygen Tanks on Fish Transport Vehicles



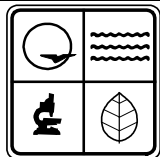
The U.S. Department of Transportation's (DOT) Office of Hazardous Materials Safety provides guidelines for the transportation of hazardous materials in the Hazardous Materials Rules and Regulations (49 CFR). These regulations apply to oxygen, which is classified as a hazardous material.

Certain exemptions apply to the use of oxygen by aquaculturists for transporting fish. A compressed gas cylinder permanently mounted in or on a transport vehicle is exempt from labeling requirements under 49 CFR 172.400a(a)(4).

Under 49 CFR 173.218(c), which lists shipping requirements of fish meal and fish scrap, Note 1 provides further information on live fish hauling. Authorized cylinders containing oxygen that is continuously fed to tanks containing live fish may be shipped regardless of the provisions of 49 CFR 173.24. This section contains general requirements for packaging and packages.

Further clarification is available from the DOT Research and Special Programs Administration's Hazardous Materials Information Center at 1-800-HMR-4922. Contact addresses are:
Information Center
Office of Hazardous Materials Standards
Research and Special Programs Administration
U.S. Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590-0001
and by e-mail at: infocntr@rspa.dot.gov.

Reference:
Office of Hazardous Materials Safety- Rules and Regulations Web site,
(<http://www.text-trieve.com/dotrspa>)
Thanks to Charles Gohring, Transportation Program Specialist, Motor Carrier and Railroad Safety, Missouri Department of Economic Development for assistance in locating HAZMAT Regulations.



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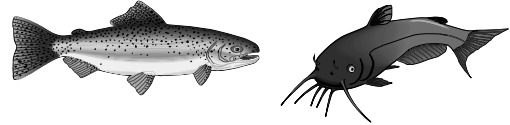
For additional information on any of these topics, contact

*Missouri Department of Agriculture
P.O. Box 630
Jefferson City, MO 65102-0630
Aquaculture Specialist
(573) 526-6666
1-800-419-9139*

*For more information call 1-800-361-4827 or write to
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June 2002

Powering Aquaculture Operations



Introduction Greater energy efficiency and use of renewable energy sources to power certain operations will help aquaculture managers reduce energy consumption and costs, improve the working environment of the facilities they manage and lessen the environmental impacts of their operations.

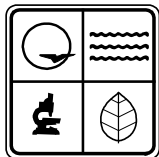
Power Source The choice of an energy (power) source for aquacultural production is between two alternatives, electric motors and internal combustion engines. Electric motors may be powered by electricity from the grid of your local utility, a generator powered by an internal combustion engine and, as technology continues to improve and become more cost-effective, a solar panel. Alternatively, an internal combustion engine may directly drive a piece of aquacultural equipment.

The type of operation and personal preferences will influence the type of power equipment selected. However, the following factors should be considered before making the decision: ability to do the job; reliability of the power source and fuel supply; initial cost of the equipment and

installation; expected useful life; convenience of operation; cost and ease of maintenance; cost to run the power plant; current and future costs; and safety.

Electric Motors The electric motor offers several advantages when the energy and standby charges are not prohibitive. Ease of operation, long life, minimal required maintenance, constant performance year after year and generally lower initial cost. The significant disadvantage is the possibility of a shutdown due to loss of electrical power. Motors of five horsepower or less can be powered from the usual 220-volt single-phase current supply. Larger motors usually require three-phase, 220-volt or 440-volt current.

Open Drip Proof (ODP) motors are typically preferred for indoor use, although they can be used in some outdoor applications. This motor runs the coolest because surrounding air is drawn inside the motor housing.



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Totally Enclosed Fan-Cooled (TEFC) type motors, operate at a higher internal temperature because heat is removed only from the outside surface of the motor. Motor cooling comes from a fan inside an air-directing shroud. TEFC motors are typically preferred where dirt, insects, moisture, etc. could affect the operation of an ODP-type motor.

An electric motor should be selected to operate at nearly full load since the motor efficiency is lower when underloaded, particularly at underloading of 50 percent or more. Standby and energy costs are also higher than necessary when the motor is underloaded. However, the motor should not be overloaded; therefore, sizing the motor deserves careful consideration to save energy and money.

The Missouri Department of Natural Resources' Energy Center is an allied partner with the U.S. Department of Energy's Motor Challenge Program and can provide assistance in selecting the most cost-effective motor for your operation. Your energy provider may also be a partner in the Motor Challenge Program and be able to provide assistance.

Internal Combustion Engines Aquaculture operations are often scattered and remote, making low-cost power from your local utility unattainable. Internal combustion engines are used in this situation. Supply and storage methods of fuel are influential

factors when selecting the power plant type. In general, internal combustion engines are best suited to higher-horsepower applications with high annual hours of use. Fuel efficiency is usually better for higher-horsepower engines that are properly matched to the load.

An internal combustion engine operates most efficiently at 75 to 90 percent of its continuous horsepower rating at its design speed.

Overloading the engine can seriously shorten the engine life and will increase fuel costs.

Underloading causes inefficient operation. As with electric motors, sizing deserves careful consideration.

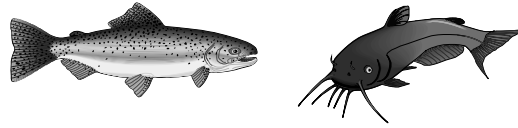
Efficiency ratings can be deceiving. The department's Energy Center can offer technical assistance regarding internal combustion engine efficiencies or provide links to other resources that can assist aquaculture operations and equipment selection.

Energy efficiency and renewable energy can improve the economics of your operation, reduce electrical demand, conserve fossil fuels and protect Missouri resources. For additional information on any of the above or additional energy related topics, contact:

*Energy Center
P.O. Box 176
Jefferson City, MO 65102
Phone: (573) 751-3443 or 1-800-361-4827*

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Preventing Fish Diseases



Experienced aquaculturists know that preventing a fish disease problem is easier than trying to cure one and usually less expensive. Fish diseases are the result of three factors: a virulent fish pathogen; adverse environmental conditions; and a susceptible fish host.

Under normal aquaculture conditions these three factors, necessary for a fish disease problem to occur, are in equilibrium and there is no disease. However, should the environmental conditions deteriorate, it will stress the fish and allow various pathogens to attack, producing a disease.

The introduction of new highly virulent pathogens can also upset the balance and result in serious disease problems even if environmental conditions are satisfactory.

Fish diseases can be reduced by maintaining proper environmental conditions, good nutrition, reducing handling and hauling stress and avoiding the introduction of serious fish pathogens. Fish diseases usually follow a gradual progression from low mortality to high mortality over a long time period. Catastrophic environmental problems such as oxygen depletion or chemical poisoning tend to develop quickly. This mortality pattern is a good

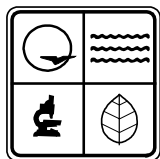
diagnostic tool for determining whether the losses are due to a disease problem or environmental problem.

Importation Permits

Due to the seriousness of certain diseases of trout and salmon an importation permit is required prior to shipping live Salmonidae, including their eggs and gametes into Missouri (Guide Sheet #15). An importation permit will be issued only if the immediate source of the fish, eggs or gametes is certified negative for Viral Hemorrhagic Septicemia (VHS), Infectious Pancreatic Necrosis (IPN), Infectious Hematopoietic Necrosis (IHN) and Myxobolus cerebralis (Whirling Disease) or other diseases that may threaten fish stocks within the state.

Fish Health Assistance

If diseases should occur, it is important to get a quick and accurate diagnosis so the proper treatment can be applied. Missouri Department of Conservation fish pathologists are available to provide fish health certification for exporting fish and to evaluate applications for trout importation permits.



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For assistance with fish health problems contact:

*Missouri Department of Conservation
Research Center
1110 S. College Avenue
Columbia, MO 65201
Phone (573) 882-9880*

References

Colour Atlas of Salmonid Diseases. David W. Bruno and Trygve T. Poppe. 1996. Academic Press Limited. ISBN 0-12-137810-1

Bacterial Diseases of Fish. Valerie Ingles, Ronald J. Roberts, and Niall R. Bromage. 1993. John Wiley and Sons. ISBN 0470-22120-8

Bluebook, Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens, Fourth Edition. American Fisheries Society, John C. Thoesen, Editor. 1994. ISBN 0-9625505-2-3

Fish Disease: Diagnosis and Treatment. Edward J. Noga. 1996. Mosby-Year Book Inc. ISBN 1-55664-374-8

Fish Hatchery Management. Robert G. Piper, et al. 1982. Fish and Wildlife Service. US Gov. Printing Office: 1982-329-150

Fish Medicine. Michael K. Stoskopf. 1993. W.B. Saunders Co. ISBN 0-72162-2629-7

Fish Pathology. Ronald J. Roberts, Editor. 1989. Baillière Tindall. ISBN 0-7020-1314-5
Fish Viruses and Fish Viral Diseases. Ken Wolf.

1988. Cornell University Press. ISBN 0-8014-1259-5

Revised and Expanded Textbook of Fish Health. George Post. 1987. TFH Publications Inc. ISBN 0-86622-491-2

Some Parasites and Diseases of Warmwater Fishes. Glenn L. Hoffman, and Andrew J. Mitchell. 1986. U.S. Fish and Wildlife service. Fish and Wildlife Leaflet 6.

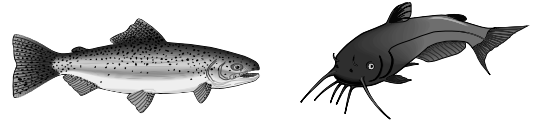
Systemic Pathology of Fish A Text and Atlas of Comparative Tissue Responses in Diseases of Teleosts. Hugh W. Ferguson, 1989. Iowa State University Press / Ames. ISBN 0-8138-0147-8

Third Report to the Fish Farmers, 14. Parasites and Diseases of Pond Fishes. Brenda Rodgers Moore, Andrew J. Mitchell, Billy R. Griffin, and Glen L. Hoffman. 1984. U.S. Fish and Wildlife Service.

The Manual of Fish Health. Chris Andrews, Adrian Exell, and Neville Carrington. 1988. Tetra Press. ISBN 3-923880-37-5

*For more information call 1-800-361-4827 or write to
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Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Private Pesticide Applicator Certification



The Missouri Department of Agriculture under the authority of the *Missouri Pesticide Use Act* regulates restricted use pesticides (RUPs) in the production of agricultural commodities. Individuals who need to purchase and use restricted use pesticides are required to be licensed as a Certified Private Applicator to purchase and use RUPs.

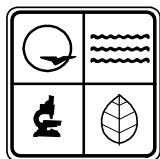
Certified Private Applicator - Any individual who is certified by the director as authorized to use, or to supervise the use of, any pesticide that is classified for restricted use for purposes of producing any agricultural commodity on property owned or rented by him or his employer or on the property of another person, if used without compensation other than trading of personal services between producers of agricultural commodities, on the property of another person.

Agricultural commodity - Any plant or part, animal or animal product produced or being produced by a person primarily for sale, consumption, propagation or other use by man or animals. (Producers of an agricultural

commodity include farmers, ranchers, vineyardists, plant propagators, Christmas tree growers, aquaculturists, floriculturists, orchardists, foresters, sod producers or other comparable persons.)

To obtain a Certified Private Applicator license, individuals must attend the Private Applicator Training Program provided by their local University of Missouri County Extension office. Programs are scheduled throughout the year and individuals should contact their County Extension office for dates and times.

The training program is three hours long and covers all aspects of pesticide use, applicator safety, label comprehension, worker protection standards, groundwater protection, and endangered species protection. If no program is scheduled, the applicator may complete the private applicator training through the use of the Private Applicator CD-Rom training program which takes approximately two hours to complete.



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Once issued, the Certified Private Applicator license is valid for five years and must be renewed by completing the Private Applicator Recertification Training Program provided by the County Extension office. To maintain the certification and license, recertification is required within each subsequent five year period.

Once certified, Private Applicators are required under federal law, administered by the United States Department of Agriculture (USDA), to keep and maintain records of use for all RUPs used. For more information about the Private Applicator Federal Recordkeeping Law, individuals should contact their local county University Extension Center.

*Missouri Department of Agriculture
PO Box 630
Jefferson City, MO 65102-0630
Paul Bailey
Certification Program Coordinator
(573) 751-5510
bailep@mail.state.mo.us*

*For more information call 1-800-361-4827 or write to
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P.O. Box 176
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June 2002

Solid Waste



Aquaculture operations produce business related solid waste. Disposal and management of solid waste is regulated in several ways by the Missouri Department of Natural Resources.

Note: Hazardous wastes are discussed in guide sheet #13 of this series.

Disposal

Most business wastes must be disposed of at a permitted sanitary landfill. In some areas where no landfill is close by, a transfer station is used as a collection point before transporting wastes to the sanitary landfill. The department's Solid Waste Management Program (SWMP) can provide you with a list of all of the permitted landfills and transfer stations in the state. The lists are available on the Internet at (www.dnr.state.mo.us/deq/swmp).

Landfills cannot accept wastes that have visible liquids in them. The test for free liquids in waste is called the "paint filter test". If a waste cannot pass the test, you may add an absorbent material such as sawdust or waste paper to bulk the waste and eliminate free liquids.

Landfills also do not accept hazardous materials, major appliances, used oil or car type batteries. Landfills may refuse any other waste if they think it will cause operating problems for them.

If you will make a long trip to take waste to a landfill, it is usually a good idea to call the office to make sure that it will accept your waste.

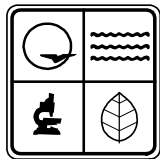
Storage and hauling of wastes before disposal are not usually regulated by the department. However, storage and hauling may be regulated or restricted by local, city or county ordinances.

When wastes are accumulated for too long they become unsightly and potentially hazardous to human health. The department's regional offices respond to citizens' complaints about such situations and often require the wastes to be cleaned up.

It is illegal for businesses to burn solid wastes for disposal unless they have an incinerator permit issued by the department's Air Pollution Control Program. For very large operations, a properly engineered incinerator may be feasible. Permits must be obtained prior to construction of an incinerator.

Management of Solid Wastes

You can decrease the amount of solid waste you need to dispose of in several ways. First you should take a look at the kinds of things you dispose of on a regular basis.



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If you have a number of small empty containers from some products, you should try to find the product in larger containers. The result will be less container waste.

You may be able to find an alternative use for some materials. Fish processing waste could be sent to a rendering plant or it could be composted if you get the appropriate permits from the department. Material from cleaning raceways and ponds can be used as a fertilizer if you have a lab test it for plant nutrient value and then figure the proper rate for fertilization.

Packaging and pallets from products you buy can often be reused or recycled. Find out if a cardboard recycler serves your area and learn how to manage cardboard for recycling. You may be able to reuse pallets, yourself or you may find a local business that could use them.

Waste petroleum oil provides another good recycling opportunity. There are special heaters that are designed to burn waste oil as a fuel source. You must follow the department's requirements for storing the oil. Information is available from the department's Environmental Assistance Office.

Remember

- Landfills cannot accept liquid wastes, however you may add an absorbent to bulk the waste.
- It is illegal for businesses to burn solid waste for disposal.
- Some waste materials can be recycled, which decreases the amount of waste needing disposal.

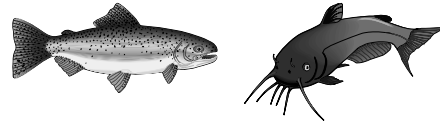
Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Sort waste materials when they are produced to make recycling easier and more productive.
- ✓ Keep outside storage areas neat and develop a regular schedule for taking recyclables to a recycling center.
- ✓ Store solid waste in ways that protect it from rain and prevent vermin breeding.
- ✓ Place waste storage containers away from wells and other source water.

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Storm Water Permits



Rainwater that falls in and around an aquaculture operation can become contaminated with sediments, chemicals and wastes. If not properly managed, contaminated water can harm the environment, pollute creeks and lakes and even contaminate drinking water.

To prevent environmental and human health problems, the federal Clean Water Act requires a permit to discharge contaminated water called a National Pollutant Discharge Elimination System (NPDES) permit. The requirements of the discharge permit are intended to minimize or prevent water pollution.

The Missouri Department of Natural Resources issues these permits, known as State Operating Permits, in Missouri. Businesses are not required to have permits unless they fit into certain categories and size groups. In Missouri there are two kinds of permits: general permits and site-specific permits.

General Permit

General permits cover an entire industry, but the individual facility operator still must apply for it and pays a small fee. General permits are issued statewide for periods of five years. If a business applies for the permit in the middle of the five-year period, it gets less than five years on the first permit.

Site-Specific Permit

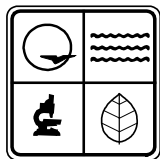
When a business stores toxic materials or large amounts of potential contaminants exposed to rainfall, needs close monitoring, or is one of only a few of its kind in the state, it may need a site-specific permit.

A site-specific permit takes into account the individual characteristics of the site and the storm water runoff. In some cases, the department may require the owner or operator of a site to apply for a site-specific permit in order to better protect water quality.

Land Disturbance Permits

If you plan to construct a new aquaculture facility or make major modifications to an existing one, you may need a Land Disturbance Permit. Currently, if the area that will be excavated and bulldozed will be five acres or more, you must contact the department's Water Pollution Control Program to apply. The project size requiring a permit will drop to one acre or more by March 10, 2003.

Land Disturbance Permits require actions to minimize and control erosion. Some of these may include detention basins, silt fences and straw mulching.



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Note: If you are required to have a discharge or wastewater treatment permit for your facility, stormwater permit requirements may be combined with the other permits.

Remember

- ➔ If you plan a construction project that will disturb five or more acres, you will need to apply for a Land Disturbance Permit before starting construction.
- ➔ The project size requiring a permit will drop to one acre or more by March 10, 2003.

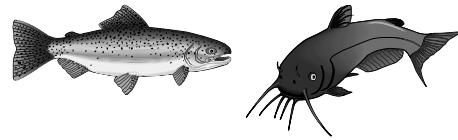
Pollution Prevention

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people. Your permit may require certain pollution prevention practices or even a pollution prevention plan. Here are some suggestions:

- ✓ Use interceptor dikes, swales or berms to direct storm water away from storage areas and areas that are prone to erosion.
- ✓ Revegetate disturbed or bare soil areas as soon as possible.

*For more information call 1-800-361-4827 or write to
Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176*

Surface Water



Aquaculture businesses need water for operations. Sources of water must provide adequate amounts and acceptable quality. This guide will discuss water from springs, rivers, streams and reservoirs. Well water is dealt with in guide sheet #26 of this series.

Department of Natural Resources' Water Pollution Control Program (WPCP) collects data about water quality and flow characteristics for many streams. This information is available at your request. Pollutants that could possibly affect aquaculture include human and animal wastes and associated bacteria and viruses, agricultural herbicides like atrazine, a number of insecticides and industrial chemicals.

WPCP also enforces *Missouri's Clean Water Act*. The discharge of pollutants into "waters of the state" can result in "fish kills" of naturally occurring fish. Fish kills are usually indicative of high levels of plant nutrients or toxicity in water bodies. Either condition would be undesirable for aquaculture.

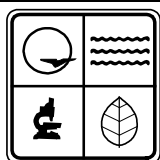
In Missouri, anyone who has equipment with the ability to withdraw 100,000 gallons or more per day from a water source must register as a Major Water User with the department's Geological Survey and Resource Assessment Division (GSRAD). This is true even if the actual withdrawals are less in volume and are infrequent.

If you have or will construct a dam over 35 feet high, it may be regulated by GSRAD's Dam Safety program. Aquaculture dams could qualify for an agricultural exemption but you need to make an exemption request. The dam safety program can also give you help with dam safety and maintenance questions if your dam is smaller.

GSRAD has also prepared a planning guidance document for drought situations. During droughts, surface water is a resource that must be managed to provide essential needs such as drinking water. It is possible that other water uses could be restricted or rationed in the event of a severe drought.

Springs are one of the most commonly used water sources for aquaculture. Although it comes from below ground, spring water may have direct connections to surface water. The large springs found in parts of Missouri provide huge flows of clean pure water, however, the shallowness of spring groundwater makes it vulnerable to contamination.

The quality of spring water can be impacted by many types of human activities. Construction and excavation, land clearing, waste disposal or treatment, manufacturing and agriculture are some of the possible sources of pollutants.



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Remember

- Water quality information for many surface water bodies is available from WPCP.
- Discharges of pollutants to waters of the state can cause “fish kills” of naturally occurring fish.
- You need to register as a Major Water User if your equipment has the capacity to withdraw 100,000 gallons per day (even if you will not actually do so).
- You need a Dam Safety permit or exemption if your dam is over 35 feet high.
- Springs are vulnerable to contamination by a number of human activities such as construction and excavation, land clearing, waste disposal or treatment, manufacturing and agriculture.

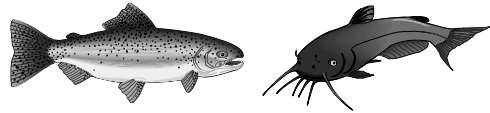
Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Construct a holding pond to empty ponds into for harvesting and pond renovations.
- ✓ Put a temporary strainer at the ends of raceways during cleaning operations to capture dislodged waste particles. Recycle or properly dispose of the waste rather than letting it flow into streams.
- ✓ Learn where the spring water you use comes from and try to avoid changes to the recharge area that may affect your spring's water quality.

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Wastewater



Aquaculture businesses generate wastewater during daily operations. This wastewater comes from other parts of the operation than the raceways or ponds used to raise fish. Sources of wastewater include business office restrooms and kitchens, laboratories, processing, storage and shipping buildings. These wastewaters may contain domestic wastes, veterinary wastes, fats, filter residues, cleaning chemicals and detergents.

Many communities provide sewage collection and wastewater treatment facilities. If your business is connected to a sewer and treatment plant, contact them to explain the materials you wish to dispose of in the sewer system.

You may need to pretreat the wastewater in some way before putting it in the sewer. For example, an oil and water separator or treatment for a particular contaminant may be required. By pretreating your wastewater, you help assure that the community's sewer and treatment system continues working for everyone.

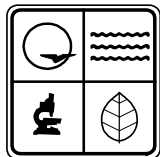
In areas where a public wastewater treatment facility is not available or cannot take your water, you must carefully manage the wastewater from your business. If your wastewater is not a hazardous waste, you can haul it to an approved wastewater treatment plant if the plant is willing to accept it. The other alternative is to treat the

wastewater yourself. This will require a permit from Department Natural Resources to assure that the treatment process you want to use will properly treat your wastewater.

If you cannot connect your offices, hatcheries and production buildings to a wastewater treatment plant, you may be able to discharge domestic wastewater (water from restroom or kitchen facilities) to a septic system. On site septic systems that treat only domestic wastewater are regulated by the Missouri Department of Health (DOH) and the county health departments if the quantity is less than 3000 gallons per day.

You will still need to collect any industrial wastewater (water from labs, filter backwash, processing, floor cleaning, etc.) and either haul it to an approved wastewater treatment plant or get a permit to treat the wastewater. Do not put your industrial wastewater down the drain unless you are connected to a sewer and treatment plant and have permission from the plant or have a permit from the department to treat your waste water.

Management practices that reduce, reuse and recycle the wastewater can greatly reduce your disposal costs. They will also help protect sewer systems and treatment plants. See the pollution prevention section that follows for some ideas.



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Note: If you are required to have a discharge or stormwater permit for your facility, wastewater treatment permit requirements may be combined with the other permits.

Remember

- If your business is connected to a sewer system and treatment plant, contact the treatment plant to find out if you can put your wastewater down the drain. You may need to pretreat your wastewater before it goes to the treatment facility.
- If your business is not connected to a sewer system and treatment plant, you can
 - Get a permit from the department to treat the wastewater yourself, OR
 - Collect the industrial wastewater and haul it to an approved wastewater treatment plant if the plant agrees to accept it.
- Do not send wastewater from your business (except restroom or kitchen waste less than 3,000 gallons per day) to a septic system.
- Never let untreated wastewater from your business go outside onto the ground, down a storm drain or into a body of water.

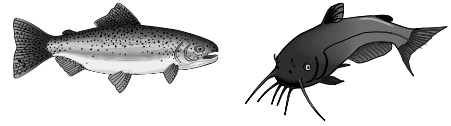
Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Sweep floors before washing them.
- ✓ Minimize the amount of water used in processing to decrease the amount requiring disposal.
- ✓ Never hose out buildings, tanks or vehicles and let the wastewater discharge outdoors into the environment.

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Water Tests for Department Permits



Many Department of Natural Resources Permits require that you test the water that is being discharged to make sure it does not contain excessive pollutants. The places where you should collect your samples are listed in the application you sent to get your permit. They are called “outfalls”.

For the aquaculture facility that qualifies for a general discharge permit, you will have to monitor annually if the design flow in your facility is less than 2 million gallons daily and monthly if your design flow is between 2 million gallons daily and 5 million gallons daily. The Effluent Limitations and Monitoring Requirements page of your permit tells you what you should test for and how often to test. You may also have some special conditions for monitoring depending on what stream receives the discharge water. You will need to send a report of all your test results to the department once a year or as specified on that page.

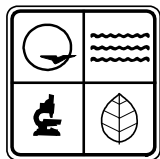
You may have a laboratory do all of your sample collection and testing if you prefer. In areas of the state that do not have any laboratories nearby, the cost of sending out a technician to collect one set of samples may be very high. You can do

some of the tests yourself but some of them may need to be done by a laboratory depending upon your abilities.

The things that are very simple to do yourself are the flow estimate, temperature readings, pH, and settleable solids. To do these you need a flow meter, Centigrade thermometer, pH meter and Imhoff Cone. There are also kits to do the ammonia test. Much of this equipment can be obtained from a laboratory supply company

If you must test for Biological Oxygen Demand, it may be necessary to use a laboratory. You should talk to the laboratory you want to use to find out if they will let you take samples for tests they will do. If they do, they will probably give you the sample bottles to use and you may also be given chemical preservatives to add to the samples according to their instructions.

Follow your laboratory's instructions carefully. It is very important that you transport the samples within the necessary time period. Follow any other requirements such as putting samples on ice or adding chemical preservatives to ensure that you get accurate test results.



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Remember

- ➔ Your department permit requires you to test water that discharges from your facility.
- ➔ If your design flow is less than 2 MGD, tests are required annually.
- ➔ If your design flow is 2 MGD to 5 MGD, tests are required monthly.
- ➔ You must send in an annual report of your water testing results to the department.

Pollution Prevention

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ When cleaning raceways, set up a temporary screen downstream to collect dislodged particles.
- ✓ Use a settling pond to remove solid particles from discharged water.

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Jefferson City, MO 65102-0176*

Wells and Groundwater



Aquaculture businesses need water for operations. Sources of water must provide adequate amounts and acceptable quality. This guide will discuss water from wells. Surface water sources are discussed in guide sheet #23 of this series.

The Department of Natural Resources' Geological Survey and Resource Assessment Division (GSRAD) regulates the drilling of wells and installation of pumping equipment. The *Well Drillers Act* went into effect in 1987. All drillers must be licensed. They are required to certify each well they drill, which provides documentation of the depth and construction characteristics for the well. A list of licensed drillers is available by contacting GSRAD.

The depth to groundwater, water quality and flow characteristics for many aquifers in Missouri is studied by GSRAD. This information is available for planning an aquaculture venture.

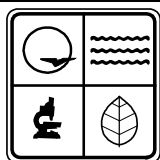
Pollutants that could possibly affect aquaculture include human and animal wastes and associated bacteria and viruses, agricultural herbicides like atrazine, a number of insecticides, nitrate and industrial chemicals. The department's Water Pollution Control Program (WPCP) enforces

Missouri's Clean Water Act. The discharge of pollutants into "waters of the state" including subsurface aquifers can result in plumes of contaminated water within aquifers. WPCP administers permitting requirements and enforces against illegal activities, which helps to protect well water quality.

Protecting Your Water Resource

The area where a well comes to the surface of the ground is called a wellhead. This area must be protected from damage. Physical damage such as might be caused by a vehicle running into the well can be prevented by installing heavy barricade posts at a suitable distance away from the well. If despite all precautions a heavy impact does strike the well, it should be evaluated by a professional to decide if the casing and piping are intact.

If your well was installed after the *Well Drillers Act* became effective, it probably was sited by taking pollution source setback requirements into consideration. If it was installed before 1987, it may be closer to some pollution sources than is desirable. It is also possible that you or a previous owner may have made changes to the area that put a well that was originally properly sited at risk for contamination.



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Some possible contamination sources are septic systems and wastewater lagoons, feedlots, chemical storage areas, fuel tanks, waste disposal containers and pesticide treated buildings. Keeping such activities adequately separated from the wellhead greatly reduces the risk of well contamination.

To protect your well from accidental contamination from cross connections, it is important to have backflow prevention installed. Guide sheet #5 in this series provides additional

information on backflow prevention. In some cases backflow devices may be required. Even if they are not, your water source is too vital to your business not to protect it.

The three approved backflow prevention methods in Missouri are Air Gap, Reduced Pressure Principle Assembly and Double Check Valve Assembly. Backflow prevention assemblies should be tested annually by a state certified backflow tester to make sure that they still work.

Remember

- Well drillers and pump installers must be licensed by GSRAD.
- Well installations must be certified with GSRAD by your driller. You will receive a copy from GSRAD but if you don't receive it within four months, contact GSRAD.
- You can protect your well from damage and accidental contamination.

Pollution Prevention

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Don't pump more water at a time than is really needed. Aquifers can be depleted and the energy for pumping is usually produced from non-renewable resources. In addition, the energy costs you money.
- ✓ Use cleaners and other chemicals that are low in toxicity and store them carefully.
- ✓ Make sure with backflow prevention that loss of pumping power will not siphon chemicals or tank water back into your well.

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